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west virginia department of environmental protection

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Office of Oil and Gas  
601 57th Street SE  
Charleston, WV 25304  
(304) 926-0450  
(304) 926-0452 fax

Earl Ray Tomblin, Governor  
Randy C. Huffman, Cabinet Secretary  
[www.dep.wv.gov](http://www.dep.wv.gov)

## PERMIT MODIFICATION APPROVAL

January 08, 2014

PDC MOUNTAINEER LLC  
POST OFFICE BOX 26  
BRIDGEPORT, WV 26330

Re: Permit Modification Approval for API Number 9101263 , Well #: UNB 6HM

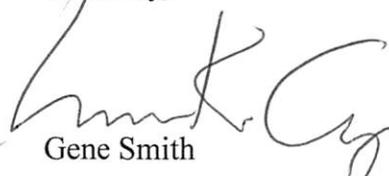
**Adjusted lateral direction**

Oil and Gas Operator:

The Office of Oil and Gas has reviewed the attached permit modification for the above referenced permit. The attached modification has been approved and well work may begin. Please be reminded that the oil and gas inspector is to be notified twenty-four (24) hours before permitted well work is commenced.

Please call James Martin at 304-926-0499, extension 1654 if you have any questions.

Sincerely,

  
for Gene Smith  
Regulatory/Compliance Manager  
Office of Oil and Gas

WW-6B  
(9/13)

STATE OF WEST VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS  
WELL WORK PERMIT APPLICATION

1) Well Operator: PDC Mountaineer LLC      494494839      Taylor      Fetterman      Gladesville 7.5'  
Operator ID      County      District      Quadrangle

2) Operator's Well Number: UNB 6HM      Well Pad Name: UNB

3) Farm Name/Surface Owner: Charles MacDonald      Public Road Access: US 119     

4) Elevation, current ground: 1878'      Elevation, proposed post-construction: 1880'

5) Well Type (a) Gas  Oil  Underground Storage

Other

(b) If Gas Shallow  Deep

Horizontal

6) Existing Pad: Yes or No Yes

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Associated Pressure(s):  
Marcellus Shale approx 7830' Thickness 80' Pressure 3900PSI

8) Proposed Total Vertical Depth: 7830'

9) Formation at Total Vertical Depth: Marcellus Shale

10) Proposed Total Measured Depth: 13,410'

11) Proposed Horizontal Leg Length: 5600'

12) Approximate Fresh Water Strata Depths: 37', 148', 254', 339'

13) Method to Determine Fresh Water Depths: Well Records

14) Approximate Saltwater Depths: None Reported

15) Approximate Coal Seam Depths: 340', 402', 507'

16) Approximate Depth to Possible Void (coal mine, karst, other): Not Known

17) Does Proposed well location contain coal seams directly overlying or adjacent to an active mine?      Yes       No

(a) If Yes, provide Mine Info:      Name: \_\_\_\_\_  
Depth: \_\_\_\_\_  
Seam: \_\_\_\_\_  
Owner: \_\_\_\_\_

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18) CASING AND TUBING PROGRAM

<u>TYPE</u>	<u>Size</u>	<u>New or Used</u>	<u>Grade</u>	<u>Weight per ft. (lb/ft)</u>	<u>FOOTAGE: For Drilling</u>	<u>INTERVALS: Left in Well</u>	<u>CEMENT: Fill-up (Cu. Ft.)</u>
Conductor	20"	new	H-40	94#	80'	80'	CCTS
Fresh Water	13 3/8"	new	H-40	48#	450'	450'	CCTS
Coal					<i>Began Here</i>	<i>10-9-13</i>	
Intermediate	9 5/8"	new	J-55	36#	2500'	2500'	CCTS
Production	5 1/2"	new	P-110	20#	13,410'	13,410'	900 SX
Tubing							
Liners							

<u>TYPE</u>	<u>Size</u>	<u>Wellbore Diameter</u>	<u>Wall Thickness</u>	<u>Burst Pressure</u>	<u>Cement Type</u>	<u>Cement Yield (cu. ft./k)</u>
Conductor	20"	24"	.756	1500	1	1.06
Fresh Water	13 3/8"	17 1/2"	.66	1730	1	1.36
Coal						
Intermediate	9 5/8"	12 1/4"	.704	3520	1	1.38
Production	5 1/2"	8.5"/8.75"	.722	12640	H	1.18
Tubing						
Liners						

PACKERS

Kind:				
Sizes:				
Depths Set:				

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19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

Drill and complete a horizontal Marcellus Shale well following all state and federal guidelines. There will not be a pilot hole drilled. Production string cement will go at least 100' into intermediate string, if not CCTS.

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

Slick water frac, pumping 80BBLs maximum. Each stage to contain approx 10,000 of water and 40,000 lbs of sand.  
Max pressure 8500PSI

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 3.6

22) Area to be disturbed for well pad only, less access road (acres): 1.3

23) Describe centralizer placement for each casing string:

Conductor: None  
Surface 13 3/8" 1 centralizer every 90' of pipe and a basket  
Intermediate 9 5/8" One every 7 joints & a basket  
Production 5 1/2" one every 12 joints in the vertical section then every 2 joints in the horizontal section

24) Describe all cement additives associated with each cement type:

See Attached Sheet.

25) Proposed borehole conditioning procedures:

Surface and intermediate holes are cleaned with air. Production hole is circulated with mud for at least 4 hours with high viscosity sweeps ran occasionally

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\*Note: Attach additional sheets as needed.

**Describe all cement additives associated with each cement type:**

**Conductor:** Type 1 Cement

✓ **Surface:** Type 1 Cement +2% CaCl + 0.25pps Cello Flake

**Intermediate: Pre-Flush – Mud Clean 1**

Type 1 Cement +2% CaCl + 0.25pps Cello Flake

**Production: Pre-Flush – Mud Clean 1**

**Lead - Class H Cement + 0.1% bwoc R-3 + 0.25% bwoc CD-32 + 1.2% bwoc FL-62 + 0.1% bwoc**

**ASA-301 + 0.4% bwoc Sodium Metasilicate + 50.5% Fresh Water**

**Tail: Type I Cement + 0.4% bwoc R-3 + 0.3% bwoc CD-32 + 1% bwoc FL-62 + 0.15% bwoc**

**ASA-301 + 50.5% Fresh Water**

**Additives:**

CaCl – Calcium Chloride – Accelerator

Cello Flake – Lost Circulation control agent

R-3 – Retarder

CD-32 – Dispersant

FL-62 – Fluid-loss control agent

ASA-301 – Sodium Metasilicate – Free water control + Solid suspension

Vendor	Product	Code Number	Component	CAS-NO.
Schlumberger	100-mesh Sand	S100	Crystalline silica	14808-60-7
Schlumberger	30/50 mesh sand	S012-3050	Crystalline silica	14808-60-7
Schlumberger	40/70 mesh sand	S012-4070	Crystalline silica	14808-60-7
Schlumberger	Corrosion Inhibitor	A264	Methanol	67-56-1
			Prop-2-yn-1-ol	107-19-7
Schlumberger	Surfactant	F108	Methanol	67-56-1
Schlumberger	HCL	H028	Hydrochloric Acid	7647-01-0
Schlumberger	Gelling Agent	J590	Propan-2-ol	67-63-0
Schlumberger	Friction Reducer	J609	Ammonium sulfate	7783-20-2
Schlumberger	Iron Stabilizer	L058	Sodium erthorbate	6381-77-7
XCHEM	Scale Inhibitor	TS-30	Sodium polycarboxylate	ND
XCHEM	Bleach	449610	Sodium chloride	7647-14-5
			Sodium hydroxide	1310-73-2
			Sodium Hypochlorite	7681-52-9
XCHEM	Chlorite	ADOX 3125/8125	Sodium chlorite	7758-19-2

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